THE INFLUENCE OF A TRANQUILIZING DRUG (MEPROBAMATE) ON LEARNING OF HIGH AND LOW ANXIETY GROUPS

By

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CHAPTER I

INTRODUCTION

One of the more notable research trends in psychology in recent years has been the investigation of the significance of certain personality variables as they influence basic psychological processes in the human organism. For example, in the area of learning, a traditional major area of psychological research, this has been particularly true in the evaluation of the operation of emotional factors generally subsumed under the term anxiety. To no little degree, study in this area has been stimulated by the original findings of Taylor (1951) who some ten years ago reported findings concerning the relationship of anxiety to the conditioned eyelid response. In this defense conditioning study she reported that high drive (i.e., high anxiety) subjects were consistently superior in development and maintenance of conditioning performance as compared to low anxiety subjects. Investigations of a similar nature, heavily weighted by the Iowa group (Spence and Farber, 1953; Spence and Taylor, 1953; Doran and Connor, 1960) have, with relatively few exceptions (Hilgard et al., 1951), tended to confirm her original findings.

When such investigations of the relationship between anxiety and learning were extended to verbal learning performances, Taylor and Chapman (1955), and Spence, Farber and McFann (1956), report a similar superiority in performance of high anxiety subjects in contrast to low anxiety

subjects. However, in learning situations where response competition was an intrinsic factor, such as in maze learning (Farber and Spence, 1953), or in complex verbal learning (Spence et al., 1956; Montague, 1953), the reverse situation prevailed, i.e., low anxiety subjects tended to be significantly superior.

Both as a basis for hypotheses formation and interpretation of results from this line of investigation, the two researchers have used as a framework basic Hullian learning theory (Hull, 1943), to some extent augmented and elaborated in a general drive theory (Taylor, 1956; Spence, 1958). This position postulates a theoretical basis for differential learning performance based upon the presumed multiplicative interaction of all habits (H) activated in a given situation with the total effective drive state (D) operating at the moment. The product of this combination forms excitatory potential (E). It follows then that given response strength is determined in part by excitatory potential, in a situation where a single habit is evoked, a higher drive level will have the effect of increasing the value of E and therefore, response strength. Taylor (1956) would predict, therefore, that in simple non-competitional experimental learning situations, such as conditioning, the performance level of high drive subjects should be greater than for low drive subjects. However, in complex learning tasks, i.e., those involving the evocation of a number of competing responses, higher drive levels do not necessarily lead to superior performance. For this situation attention must be given to the additional variables of oscillatory inhibition and threshold. Consequently, from an array of competing responses, the one most likely to occur at a given moment will be the highest suprathreshold momentary excitatory strength (E). Specifically, the appearance of the correct

response tendencies as interactive between drive level and the number and comparative strengths of correct or incorrect tendencies. Accordingly, where the correct response is weaker than one or more of the competing response tendencies, the high drive groups are at a definite disadvantage. This is true because the stronger incorrect tendencies gain relatively more E than the correct tendencies in the case of the high drive subjects than in the low drive subjects leading to a greater probability of occurrence of the stronger incorrect responses in the high drive group (Ramond, 1953; Taylor and Spence, 1952). A further handicap to which high drive groups are subject is that new, competing responses with very weak habit strengths may be brought over the threshold of E with the consequence that the probability of occurrence of the correct response is lowered relative to that in low drive condition. The most extreme contrast in performance differential could be expected when both a large number of competing tendencies are present and the correct tendency is both relatively weak and low in the hierarchy. Increasing the strengths of the correct tendency could be expected to close the performance gap between the two until a point is reached where high drive subjects are even superior (Montague, 1953).

A two-phase, paired-associate learning study by Spence et al. (1956), illustrates the essence of the above-described differential learning performance as a consequence of the interactive effects of anxiety level and position in the response hierarchy of responses to be learned. The first phase of this study utilized a word list designed to produce maximum associations between the words in each pair while minimizing intraserial interference. The list used in the second phase of this experiment was contrariwise designed to encourage intraserial

interference and decrease associations within each pair. In keeping with drive theory predictions, in the case of the first list, the high anxiety group excelled; they made significantly fewer errors and took fewer trials than did non-anxious subjects. However, in the case of competitive response list, anxious subjects required significantly more trials to reach criterion.

In the foregoing experiment, as in both prior and succeeding studies of this nature by the Iowa group, the drive level variable has been manipulated by the choice of subjects on the basis of extreme scores on a scale of manifest anxiety (hereafter referred to as the MAS) developed by Taylor (1953). Both Taylor (1956) and Spence (1958) in their use of the scale assume that drive level is a function of the magnitude and strength of a hypothetical response mechanism, i.e., a persisting emotional response in the organism. A second assumption is that the intensity of this emotionality can be ascertained by paper-pencil test of items of overt or manifest symptoms of this state. That the use of the MAS as a measure of drive (D) may be the weak link in envisioning the significance of the findings of the Iowa group, has been pointed out by Jessor and Hammond (1957). Spence (1958) has, nevertheless, defended its use on the grounds that it was, in fact, developed independently of the measures that were to be employed in testing the theoretical network; that is, the performance measures in conditioning and the learning situation.

Psychopharmacological Research.--In the past, studies dealing with human drive level (i.e., anxiety) and its relationship to learning performance have typically relied on relatively indirect control of the drive variable. This has been largely accomplished through the use of selection procedures in which subjects are chosen on the basis of extreme scores on

paper-pencil tasks measuring the variable in question. Indeed, until fairly recent advances in the development of ataraxic medications, relatively direct manipulation of drive level has been impossible. Of the one proliferating development in such drugs, the drug Meprobamate (trade name: Miltown) has, since its discovery (Berger, 1954), been the object of considerable investigation both in clinical and laboratory settings. It has enjoyed widespread use for its purported efficacy in allaying anxiety and tension states (Osinski, 1957; Sorrus, 1957; Yost and deFonso, 1956). Unlike barbiturates which tend to create relatively widespread physiological effects, Meprobamate has its site of action within the regulatory subcortical brain structure, i.e., the thalamus and intermuncial neurons of the spinal cord (Hollister, 1958). The behavioral consequences of the drug are then to produce calm without producing sleep. Vogt (1958), in an appraisal of the pharmacological properties of general tranquillizing agents, notes that Meprobamate has the capacity to check emotional responses while not interfering with skill, rational behavior and adequate responses to environmental stimuli. These features plus its low toxicity level and minimal side effects (Marquis, 1957), due in large part to its lack of effect upon the autonomic nervous system and greater effectiveness with milder anxiety states, make it an interesting one in terms of its possible alterations of anxiety level and subsequent influence upon psychological performance.

Kelton (1957) performed such a study to determine the relative influence of Meprobamate with normal subjects on performance on a battery of psychological tasks. The subjects tested received the normal degree of drug dosage within a six day period prior to testing. He found an impairment of speed of fine movements, alertness, accuracy of visual-motor coordination, reaction time or complex problem solving ability.

Marquis (1957), also using a population of fifty enrol adult subjects, tested them on five successive days on measures of reaction time, driving skills, steadiness and visual performance. On each of the five days subjects were tested following ingestion of one-shot doses of either placebo, Meprobamate and alcohol or a combination of these. Meprobamate by itself appeared to have as significant influence as any of the performance measures.

Holliday and Willis (1958) took the foregoing type of studies a step further by imposing a contrived stress (i.e., electric shock) producing situation upon a perceptual motor task. They hypothesized that tranquilizers, in this instance Thorazine and Meprobamate, will allow subjects to perform more efficiently during non-punishment trials than would a placebo. Prior to the introduction of the drug variable their four groups were equivalent in pointer pursuit apparatus performance. Likewise, there was no reported difference between these groups following ingestion of drugs; however, the introduction of a punishment variable resulted in marked increase upon performance levels in subsequent non-punishment trials to which the groups responded in differential fashion. Of the four groups (Meprobamate, Thorazine, Pentobarbital and placebo), only the Meprobamate group exhibited continued improvement in performance or continuing capacity for learning over successive trials following punishment. The authors conclude that Meprobamate tends to abolish the disruptive effects of anxiety.

In contrast to the apparent stress relieving properties of Meprobamate found in the foregoing experiment, Pronko and Kenyon (1959) reported no difference between placebo and Meprobamate condition among fifty-one college student subjects. These subjects, acting as their own controls,

were tested on their ability to read aloud and simultaneously perform simple motor manipulations under conditions of delayed auditory feedback. One-shot doses of drug or placebo were administered thirty-five to forty-five minutes prior to performance proper. These authors, using a similar drug dosage as did Marquis (1957), likewise found no effect of Meprobamate upon performance.

When the present study was initiated there were no accounts in the literature of investigation of the effects of Meprobamate on verbal learning. In the meantime a few reports have appeared. Using sixty-one paid male and female subjects, Burnstein and Berfman (1959) ran groups of eight to twelve persons in a competitive verbal learning situation, utilizing auditorily presented word lists developed by Spence et al. (1956). Prior to testing and in a double-blind procedure, subjects were given three times the usual dosage of Meprobamate, i.e., 1200 mg. or three placebos. The learning task consisted of correctly anticipating, by writing, the response word before the sounding of a buzzer. They reported a higher rate of learning from the Meprobamate subjects as compared to placebo subjects, a difference significant at the .05 level of confidence.

As one aspect of a larger study in which several broad parameters of the actions of three phenothiazine agents were studied (i.e., Reserpine, Phenyltoloxamine, and a placebo), Brown et al. (1958) tested ten male subjects on a variety of psychological tasks. Subjects were informed they would be given tranquilizing agents, a placebo or a combination of these on three experimental days. Of the variety of tasks administered these subjects pertinent to the present study, is their performance in a paired-associate learning task involving a competitive response word list. These authors report some differential effects of Phenyltoloxamine

and Reserpine upon this type of performance. Yet in neither case was speed or accuracy of learning facilitated as indicated by placebo comparisons. In fact, the Reserpine drug group performance in trials was significantly below that of the other conditions. To eliminate the possible drug effect on relative anxiety levels, the authors extracted MAS items from completed MMPI tests. Their assessment of this variable was that, regardless of the drug taken, the high anxious subjects took one more trial to reach criterion and made more errors than the low anxious subjects. They concluded that their findings were not consistent with their initial predictions based upon current psychiatric or psychological concepts of anxiety.

The existing evidence concerning the effects of tranquillizing agents upon verbal learning, taking into consideration relative degrees of subject anxiety is somewhat equivocal. Eurostels and Dorfman (1959) were purportedly testing hypotheses derived from Hullian theory. Yet there was no attempt to make other than a gross assessment of drug effect, in that an evaluation of subject anxiety level was made. Although Brown et al. (1958), testing a tranquillizing agent other than Meprobamate, made verbal learning performance comparisons of high and low anxious subjects, their restricted sample raises some doubt about their findings. It seemed desirable, in light of this relative paucity of knowledge in this area of psychopharmacology, to study more thoroughly the drug Meprobamate on human learning performance. The use of this drug makes possible relatively direct manipulations of emotionality or drive level and therefore, opens up the possibility of relating the physiologic operation of a drug to existing learning theory. Accordingly the following hypotheses

present themselves:

1. The performance of high anxious subjects will be inferior to low anxious subjects on a complex verbal learning task.

2. The administration of the drug Meprobamate to high anxious subjects will have a facilitative effect upon their complex verbal learning performance.

3. The administration of Meprobamate to low anxious subjects will tend to impair their complex verbal learning performance.

CHAPTER II

METHOD

Subjects.--The subjects of this study consisted of 95 male and female undergraduate psychology students, ranging in age from nineteen to twenty-seven years. All subjects were unpaid volunteers, though many received course credit for their participation. Subjects were randomly assigned into drug, placebo, and nothing conditions on a predetermined basis utilizing a random number process. They were further subdivided into either a "high anxious" or "low anxious" group on the basis of their MAS scores. In contrast to the selection of extreme population samples, e.g., as followed by Taylor and others, the entire range of MAS scores was utilized. The cut-off score was, in this instance, arbitrarily set at the median of the obtained sample of MAS scores. In totality six groups of subjects were involved in this study. No special subject criteria were involved except that persons on a prior regime of specialized medication, or those having known medical problems (e.g., endocrine or metabolic disturbances, etc.) were barred from the study. A serendipitous advantage for the purposes of this study accrued from recruiting volunteers from the particular subject pool mentioned above, in that many, being freshmen, had recently undergone a medical examination prior to University admission which would have alerted them to possible contraindications of participation. Legalistic considerations made it necessary for all subjects under age twenty-one to have a signed parental release before acting as subjects.

Apparatus.--A Hull-type memory drum was used to present one of two twelve-item paired-associate word lists. Successive words were presented at the rate of one every five seconds. This included a 2.17 second anticipation interval. The intertrial rest period was five seconds in length. Both stimulus lists, consisting of two-syllable adjectives, were extracted from Haagen's (1949) word lists (Table 1).

TABLE 1.--Word lists of paired adjectives used in testing learning performance

List I		List II	
Stimulus	Response	Stimulus	Response
* Barren	Fruitless	* Angry	Irate
Arid	Grouchy	Raging	Through
Desert	Leading	Bitter	Extinct
* Little	Minute	* Distant	Remote
Petite	Yonder	Far off	Downcast
Undersized	Wholesome	Removed	Precious
* Roving	Nomad	* Winding	Spiral
Gypsy	Opaque	Coiled	Unclear
Migrant	Agile	Twisted	Mammoth
* Tranquil	Placid	* Hidden	Concealed
Quiet	Double	Secret	Outworn
Serene	Headstrong	Private	Youthful

One of the lists (List II, Table 1) was devised specifically for this study to test the generalizability of the methods and findings of Spence et al. (1956). The other list is the one developed and utilized by the Iowa group. The main objective in the construction of both lists was to create a learning task in which intraserial interference would be maximized and, contrariwise, intralist associations and formal similarities would be reduced. Starting with a core of four words, paired with four highly synonymous response words, two stimulus words, also relatively

synonymous with each of the four base words (marked by asterisks, Table 1) were also selected. These latter words were then paired with response words for which they had little association value. As demonstrated by Spence et al. (1956), the effect of this type of list construction is to foster response competition as a consequence of the similarity of stimulus words. As a further aid towards achieving this goal, both lists were presented in three different orders so as to preclude serial learnings.

Drug Administration.--Each subject, assigned to one of the pill conditions and following a set of mimeographed instructions, was requested to report to the University Infirmary where they received an envelope containing twelve pills. At the infirmary the pharmacist, under the direction of the infirmary medical director, dispensed either placebos or the drug to those subjects assigned to a pill condition on a pre-arranged random order basis. The pharmacist also maintained a record of what each subject received. The nature of the pills was not revealed to the subject nor was the experimenter aware of which group each subject fell into (i.e., drug versus placebo) until the conclusion of the experiment. To the extent that the pharmacist dispensing the pills was aware of the nature of the pills given to each individual subject, requirements for a complete double-blind control did not obtain in actuality.

Prior psychopharmacological studies, partly to evaluate the likelihood of behavioral response, have typically resorted to the administration of a "one-shot" massive dosage level of drug at a specified period of time prior to experimental testing. Subjects are then tested at presumed peak periods of maximal drug effect. In the present study, to avoid the artificiality of this procedure, and to allow for a more natural adaptation and build-up

of offset, it was decided that the average daily clinical dosage of the drug be employed for a period of three days prior to testing. Accordingly, subjects took four 400-mg. Meprobamate tablets daily (or a like number of placebo tablets in the control group) for the aforementioned time period. Subjects were not required to follow a rigid time schedule for the ingestion of the pills except for the last one which was to be taken two hours before the testing session. The instruction sheet provided subjects advised only that pill taking be spaced evenly throughout the waking day. Since a rigorous control over each of the individual subjects' pill taking was not feasible, no attempt was made, on the part of the experimenter, to create a permissive atmosphere regarding this aspect of subject behavior. As such, subjects were encouraged to inform the experimenter when unusual deviations from the prescribed pill taking regime had occurred. In this instance subjects were free to drop out of the study or, when they preferred, they were allowed to resume a new sequence after a suitable time period. In this situation the only practical control to determine if subjects had actually taken the pills was to simply ask them at the time of testing.

Procedure.--At the experimental sessions subjects were required to learn one of two, twelve item, paired-associate word lists to a criterion of two consecutive errorless trials. Subjects were presented with directions to read, describing the nature of the task. This had the effect of standardizing instruction for all subjects. In essence, the typewritten instructions for all subjects described the anticipation method, the technique to be employed in the learning process.

Each stimulus list was presented in three different sequential orders

to prevent serial learning. In addition, the lists were counterbalanced in their presentation to the individuals comprising the several groups tested.

A "t" test of the difference between means for the two lists was completed following the data collection. No significant differences were observed.

Every subject in this study underwent the above-described individual sequence; subjects were tested either under a drug, placebo, or a condition of no pills.

Following the learning of the list, subjects were asked to complete the MAS. When this was accomplished a short inferral interview ensued to obtain certain identifying data and to determine the existence and nature of phenomenological experience while in the pill taking sequence. Another function served by the interview was to determine subjects' reactions to test stimuli pertaining to learning procedures. The primary function of this interview was, however, to ascertain, as best as possible, whether the subjects in the pill groups had taken all the pills as directed and had not subjected him or herself to unusual internal or external conditions which would tend to invalidate his or her experimental performance and lead to ambiguous data. For example, data from subjects who admitted to taking other medication during their course as subjects had to be eliminated. This was equally important procedure for the non-pill control group.

In the early phase of this study, this inferral interview was followed by a test of retention at three specified time periods ranging from fifteen to thirty minutes. This test of memory was later abandoned as an aspect

of study when it became apparent that in this relatively short time period following original learning, there was little, or no, variation in retention regardless of group or condition.

Scoring.--Performance measures included both the number of correct anticipations and the number of errors needed to reach criterion. Error scores consisted of both overt intrusions of incorrect responses as well as instances of no response. Where it appeared that a subject's correct response occurred simultaneously with the appearance of appropriate response in the memory drum window, the subject was given credit for that word pair.

CHAPTER III

RESULTS

In order to test the hypotheses set forth in the first chapter, a three-way factorial analysis of variance design was employed. The dependent variables being tested were trials and error scores to learning criterion for each subject. Preliminary analysis indicated possible performance differences between sexes; therefore, sex was included in the analysis as a source of variation. In both major analyses a method for dealing with unequal cell frequencies (of a twelve-cell table in this instance) was employed (Walker and Lev, 1953).

Trials Analysis.--The pattern of performance predicted, both in terms of a significant differential performance level for high and low anxious groups, as well as for a treatment-anxiety level interaction, did not obtain. Table 2 reveals the sole significant source of variation to be attributable to sex differences. The F for sex was 9.63, highly significant beyond the .001 level of confidence (df 1,83). Examination of mean comparison scores in Table 3 shows this difference to reflect the superiority of female subjects over male subjects, regardless of anxiety level or treatment group.

A breakdown of the total group according to the independent variables of treatments and anxiety level reveals a poorer performance for both the HA drug and HA placebo groups as compared to a non-pill control group (Table 4). This trend may also be observed in Figure 1 in which percentages of the total material learned per trial, are plotted. The fact that the

curves are not separate but do overlap at various points, attests to the fact that treatment effects are non-significant.

TABLE 2.--Analysis of variance of trials to criterion for two anxiety groups under three treatment conditions

Source	Sum of Squares	df	Variance Estimate
Sex	435.8553	1	435.8553 *
Anxiety level	36.3460	1	36.3460
Drug	16.1314	2	8.0607
S X A	110.7885	1	110.7885
S X D	49.5329	2	24.7664
A X D	165.1444	2	82.5722
S X A X D	38.7393	2	19.3696
Within	3,753.9038	83	65.2277
Total	4,606.4316	94	

* p. .001.

The LA groups in the drug and placebo conditions, on the other hand, can be seen to have learned more rapidly than did not only their HA counterparts, but also learned more rapidly than did a LA non-pill control group. It may also be observed in Table 4 that the HA and LA non-pill groups were the most nearly alike of any of the between-anxiety level comparisons. More remarkable than this, however, is the truncated range of obtained mean scores where the margin separating the best and worst performances was less than five mean trials.

TABLE 3.--Means and standard deviations of trials to criterion for all groups under all conditions.

Anxiety Level		Drug		Placebo		Nothing	
		M	F	M	F	M	F
High	M	22.1666	16.0000	21.6666	18.3333	21.2500	12.8000
	SD	5.48	7.10	7.36	4.30	5.81	4.71
	N	6	4	6	6	16	10
Low	M	18.6250	14.9000	15.2857	14.0000	19.7500	17.7500
	SD	5.56	4.38	7.18	2.34	7.39	8.50
	N	8	4	7	4	16	8

TABLE 4.--Mean trials to criterion and standard deviations by group membership

Anxiety Level	Drug			Placebo			Nothing		
	N	M	SD	N	M	SD	N	M	SD
High	10	19.0833	6.60	12	19.9999	6.25	26	17.0250	7.25
Low	12	16.5625	5.55	11	14.6428	5.93	24	18.7500	7.06

Analysis of Errors.--An analysis of variance of error scores, on to the ones of the variance analysis from trials, show no significant treatment *of* effects or interactions (Table 5). An interaction of sex with anxiety level approaches (F 3.14, df 1,83), but falls short of statistical significance. Sex differences are again high significant (F 10.1) beyond the .001 level, with women once more superior to the

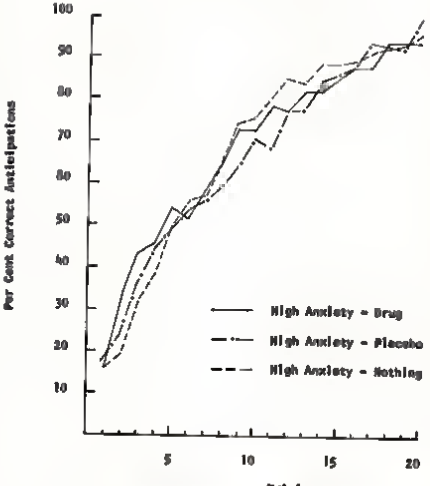

Figure 1.--Percentage of Correct Anticipations per Trial for High Anxiety Groups under Three Different Treatments.

men in their performance (Table 6).

TABLE 5.--Analysis of variance of error scores to criterion for two anxiety groups under three treatment conditions

Source	Sum of Squares	df	Variance Estimate
Sex	13,494.1861	1	13,494.1861 *
Anxiety level	387.8300	1	387.8300
Drug	854.5289	2	427.2644
S X A	4,190.7176	1	4190.7176
S X D	1,072.8300	2	536.4150
A X D	1,906.2343	5	953.1171
D X A X S	772.3288	2	906.1644
Within	110,732.9663	83	1334.1321
Total	133,411.6220	94	

* p. .861.

When mean error scores are compared between the three treatment conditions according to anxiety level, it can be seen that the drug apparently had an influence on the errors made by the HA group (Table 7). The LA drug group, in contrast made more errors in learning than did all other groups. This tendency is illustrated most vividly in a graphic comparison of the learning sequence of the three LA groups (Figure 2). Regardless of this finding, reference to Table 4 shows that this same group took fewer trials to reach criterion than did all other groups with the exception of the LA placebo group. The LA placebo group demonstrated overall superiority on both measures of learning. Their HA counterparts

demonstrated the poorest overall performance of all groups tested.

Error score variation is, disregarding sex groupings, relatively small from group to group, and underlies the null hypothesis that such variation is merely representative of chance fluctuation.

TABLE 6.--Means and standard deviations of errors to criterion for all groups under all conditions

Anxiety Level		Drug		Placebo		Nothing	
		M	F	M	F	M	F
High	M	99.3333	50.5000	94.3333	71.6666	94.7500	53.3000
	SD	39.10	26.55	40.45	20.92	40.60	17.02
	N	6	7	6	6	16	10
Low	M	52.0000	70.2500	66.2857	59.2500	79.8125	72.2500
	SD	34.13	28.35	37.18	15.60	34.71	42.64
	N	8	4	7	4	16	8

TABLE 7.--Mean error scores to criterion and standard deviations by group membership

Anxiety Level	Drug			Placebo			Nothing		
	N	M	SD	N	M	SD	N	M	SD
High	10	74.9166	42.1	12	82.9999	34.1	26	74.0250	39.1
Low	12	61.1250	33.9	11	62.7867	31.3	24	76.0312	37.7

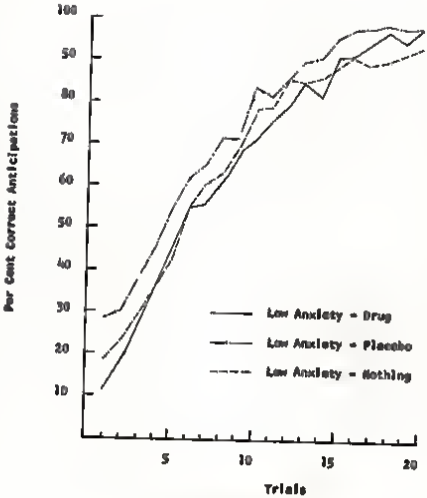

Figure 2.--Percentage of Correct Anticipations per Trial for Low Anxiety Groups under Three Different Treatments.

CHAPTER IV

DISCUSSION

The general purpose of this study was to assess and investigate alterations in learning performance as a function of drive level (D) manipulated through the use of a pharmacologic agent. Inherent in this statement of purpose is the basic assumption that drive differences exist between the experimental groups. Furthermore, it is assumed, on the basis of drive theory and some supporting research evidence that performance differentials on a learning task will result as a consequence of the interaction of varying drive levels and the number and strength of competing response tendencies.

In the present study the paired-associate learning task was devised to foster response generalization (i.e., it was a competitive response situation). The obtained F values for differences in performance between HA and LA groups fail to demonstrate the expected superiority of the LA group. The trends, however, are in the expected direction and lend small, if non-significant credence, to previous findings of studies of this nature (Taylor and Chapman, 1955; Spence et al., 1956).

In attempting to ascertain the reasons for this discrepancy, several possibilities present themselves. First of all, deviations from prior research procedure could be of some portent. Essentially these deviations involve the use of a median group split as opposed to the use of extreme MAS scorers; the use of a newly devised stimulus word list, and a longer stimulus exposure and intertrial period. Of these the first

two may be discussed on the basis of available knowledge. The definition of HA and LA groups is quite arbitrary at best, and selected cut-off score points vary widely even among these researchers from study to study. The possible influence of differences in difficulty level between the two stimulus lists may be discussed on the basis of non-significant "t" tests for both trials and errors for the two lists. The last of the aforementioned possibilities (i.e., the elevated stimulus exposure time) could, of the three things mentioned, be of some consequence. It has to be assumed that the relatively short stimulus exposure times of paired-associate materials utilized in other investigations provided an element of psychological stress. It may be further speculated that this stress becomes critical at some point for HA subjects in a competitive response learning situation. Extending the stimulus exposure time may well have significantly reduced the source of stress, tending to obscure formerly observed differential learning performances based on anxiety level differences. Having thus far gone unconsidered, this aspect is something yet to be explored. In addition to the reasons thus far offered to explain the present findings, is the nature of the sample. The persons who volunteered for this study knew that participation as a subject would involve the taking of pills. When this fact is considered along with the fact that no special inducement or remuneration was offered subjects, there is a likelihood that the resultant sample was a more highly select, less heterogeneous group than would be found in other types of psychological research. Indeed, Richards (1960), reporting on a study of volunteers versus non-volunteers for research on a drug, found differences in personality of the two groups. Most significant for the present research was his statement that volunteers tend to be less repressive of anxiety

and deal with it by intellect. His plea for caution in drawing inferences from drug studies using volunteers is a point that has been emphasized by others (Lasagna and Felsinger, 1954).

In defense of the present findings it should be noted that there are a number of studies which have not upheld, or only partially upheld, drive theory predictions for learning performance outcomes based on drive level differences (Meltzer et al., 1956; Seitz and Hoehn, 1957; Hilgard, et al., 1951). In actuality the Spence, Taylor, Ketchel (1956) study reported only partial confirmation of predictions. This last study, which gave rise to the present one, found HA subjects significantly superior to LA subjects when learning involved a minimum of competition. However, when learning involved competing response tendencies, the predicted superiority of LA subjects was only manifest in a trend, not in actual statistical significance.

In the face of inconsistent, often non-supportive research (primarily from the non-Iowa group) and under attack both for the tenets of the Hullian derived drive theory (Hill, 1957) as well as for the construct validity of the MAS (Jessor and Hammond, 1957) there has been a retrenchment in the Taylor-Spence position. On the one hand Taylor has conceded that there are many other characteristics than drive level on which HA and LA subjects differ (Taylor, 1958). Spence (1958), while acknowledging the efficacy of drive theory in predicting the outcome of conditioning studies, is reluctant to extend present theorizing to include complex human learning. He now states that at its present stage of development, drive theory cannot accurately predict outcome of paired-associate learning beyond the first few trials.

Predictions relating to the major focus of this study, i.e., the use of Meprobamate to alter drive level, and ultimately learning performance, have not been upheld. The trends are in the opposite direction from the predictions. For example, the HA drug group took more trials to reach criterion than did the control (i.e., non-pill) group. Error scores on the other hand for the HA drug group showed a remarkable consistency with the non-pill group.

In contrast to these findings, it is noted that the LA drug group took fewer trials to reach criterion than did a non-pill control group, yet made more errors in doing so, when compared with other LA groups. This latter point is a partial confirmation of the prediction that LA drug subjects would show impaired learning performance comma under the influence of Meprobamate.

It is interesting to note that the best learning performances occurred in the LA placebo group. Their superiority over a control group is highly suggestive of a placebo effect (Lasagna et al., 1954).

Examination of the data on the HA placebo group shows it to have learned least efficiently. It could be speculated that the (frustrated) expectancy that something could occur as a consequence of pill taking somehow interacts with an already existent elevated drive level. As a consequence of this interaction further impairment in learning efficiency is incurred.

In the evaluation of the negative findings regarding the influence of the drug variable, several factors should be examined. One of these has to do with the inability to impose the relatively rigorous controls which is possible in other types of psychological research with humans. Proper preparation of drug-placebo subjects was, at best, only indirectly

a result of the investigator's efforts. The responsibility for taking all pills at reasonably equivalent time intervals was left to the individual subjects. The investigator, in this instance, had to rely upon the statement of individual subjects that they had in fact consumed all the required pills. Clinical laboratory tests could have given a partial confirmation of the veracity of such statements. However, the mechanics of such an operation would have proved prohibitive.

Secondly, it would have been desirable to use at least the different drug dosage levels, preferably three, in order to establish a response curve. This was unfeasible on two counts. The first of these has to do with the particular sample studied, i.e., college students. The use of elevated dosage levels would have incurred university administration objections.

More important, however, is the fact that the present study was not designed to be essentially psychopharmacologic in nature. The only interest was in all-or-none effects utilizing a normal drug dosage.

Another factor that should be considered is the nature of the drug itself, especially as this relates to the sample tested. Meprobamate is considered a relatively mild tranquillizing agent, whose efficacy in the treatment of anxiety is not entirely agreed upon (Lacles and Weiss, 1958). The population tested was a non-clinical one and could be assumed to be freer of anxiety than a patient group. The implication of this argument is that a mild drug may have little influence on so essentially "normal" sample.

The issues involving the nature of the population tested, and potential sex differences, are ones which have previously been considered, but are pertinent factors in this context as well.

Plainly, the results relating to drug effects are generally in keeping with the results of other studies involving the use of Meprobamate with normal subjects. Generalizing from such results, it can be said that Meprobamate has neither a facilitative nor debilitative influence upon psychological performance (Raines, 1957; Marquis et al., 1957). Only when external stress is imposed upon psychological performance does Meprobamate appear to influence performance (Holliday and Gills, 1958). This element of stress, perhaps lacking in the present study, may account for the positive findings reported by Burnstein and Dorfman (1959) who similarly investigated the influence of Meprobamate upon paired-associate learning. In that instance, group testing procedures may have added an element of stress.

Sex Differences in Paired-Associate Learning.--As noted in the report of results, the sole significant performance differential was attributable to sex differences. The superiority of the female subjects is an unexpected one, both in terms of drive theory predictions, as well as in terms of the results of prior investigations. In only a few rare instances have sex differences been tested and reported upon in this area of research. Spence and Farber (1953) did note that women performed at a higher level than did men in conditioning performance. These authors made little of this finding since statistical significance did not obtain. In one of the other few instances in which possible sex differences was scrutinized as an aspect of the experimental design, Haller et al. (1956), reported a significant relationship between anxiety level in men and errors made in a complex verbal learning task. This relationship did not hold up for women, for whom a separate analysis was done.

Carlson and Carlson (1960) have recently stated that serious difficulties see arise in studies using extreme groups which fail to test for sex differences. In this situation some differences between sexes may lead to an imbalance of sex in the groups selected for intensive analysis. They suggest for studies of extreme groups involving both sexes that samples be drawn from separate distributions according to sex. That general use of this procedure is seemingly minimal in studies of extreme groups, raises certain questions of doubt concerning the validity of reported conclusions in such studies.

Implications.--The major predictions being unsubstantiated by these findings raise doubts relating to the ability of MAS scores to accurately reflect drive level. Additionally, the adequacy and/or sufficiency of drive theory tenets, particularly as they pertain to presumed drive level interactions to determine performance, are also in doubt. The deviations of procedure involved in this study from those of the Iowa group, plus other non-confirmation of drive theory predictions in which carrying procedures were utilized, suggest that drive theory predictive qualities may be valid only within a limited range of conditions.

A major implication for future research in this area could be studies of the nature of drive level, its manifestation and influence upon psychological performance between sexes. Another study might consider, in addition to possible drive level-sex interactions, drug-sex interactions. The present study suggests for example, a greater response to both drug and placebo for sex as opposed to women. Finally, it would seem that in future drug studies, some attempt be made to assess the psychological meaning of pill taking to the subjects involved.

CHAPTER 5

SUMMARY

The purpose of this study was to evaluate the influence of Meprobamate upon paired-associate verbal learning performance of high and low anxious groups.

Following the drive theory notions of Spence and Taylor for competitive response learning situations, it was predicted that high anxious (i.e., high drive) subjects would be inferior to low drive subjects in their learning performance.

It was additionally hypothesized that this pattern of differential learning performance, predicated upon an interaction of drive level with the nature of the learning task, could be altered through the administration of Meprobamate. The resultant alteration was predicted to take the form of facilitation of learning for the high drive groups and impairment for the low drive groups.

The 95 volunteer undergraduate students (59 males and 36 females) comprising the subjects of this study were randomly divided into a non-treatment or pill condition. Those in the latter category were assigned to either a placebo or drug condition. Further subdivision into high or low anxious groups was made for all subjects on the basis of their MAS scores.

Subjects taking either Meprobamate or placebos were tested under double-blind procedure. A three day period of pill ingestion, utilizing a normal clinical dosage level for Meprobamate, preceded the experimental

session for the pill groups.

All subjects at the test session were required to learn one of two paired-associate word lists to a criterion of two consecutive error-less trials. The anticipation method was employed on in the learning process.

An analysis of the results failed to support the major hypotheses. Generally the results were in opposition to predictions. The implications of these results were discussed.

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BIOGRAPHICAL SKETCH

Andrew A. Farinacci was born on January 25, 1929 in New York, N.Y. He attended high school in Washington, D.C., graduating from McKinley High School in June, 1946.

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In September, 1952 he initiated graduate study at George Washington University. He was awarded the degree of Master of Arts in 1956. In the meantime he had enrolled at the University of Florida where he was a graduate assistant in the Reading Clinic. He was later employed as a Research Associate in the Department of Psychiatry at the J. Hillis Miller Health Center.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

February 3, 1962

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